



US 20090188805A1

(19) **United States**(12) **Patent Application Publication****Moffat et al.**(10) **Pub. No.: US 2009/0188805 A1**(43) **Pub. Date: Jul. 30, 2009**(54) **SUPERCONFORMAL ELECTRODEPOSITION
OF NICKEL IRON AND COBALT MAGNETIC
ALLOYS**(75) Inventors: **Thomas P. Moffat**, Gaithersburg,
MD (US); **Chang Hwa Lee**,
Gaithersburg, MD (US); **Daniel
Jossel**, N. Potomac, MD (US);
Soo-Kil Kim, Seoul (KR)

Correspondence Address:

Steve Witters, PLLC
930 Woodland Ridge Circle
LaGrange, KY 40031 (US)(73) Assignees: **GOVERNMENT OF THE
UNITED STATES OF
AMERICA, AS REPRESENTED
BY THE; SECRETARY OF
COMMERCE, THE NATIONAL
INSTITUTE OF STANDARDS
AND TECHNOLOGY**(21) Appl. No.: **12/358,628**(22) Filed: **Jan. 23, 2009****Related U.S. Application Data**(60) Provisional application No. 61/023,593, filed on Jan.
25, 2008.**Publication Classification**(51) **Int. Cl.**
C25D 5/02 (2006.01)(52) **U.S. Cl.** **205/119**(57) **ABSTRACT**

A process for electrodepositing at least one ferromagnetic material into a three dimensional pattern within a substrate is provided. The process comprises providing a substrate material, dielectric or conductor, having a three dimensional recessed pattern in at least one outer surface thereof, dielectric substrate materials also having an electrical conductive seed layer at least within the three dimensional pattern. An electrolytic bath is prepared comprising at least one ferromagnetic material and at least one accelerating, inhibiting, or depolarizing additive. The at least one ferromagnetic material comprises at least one metal cation selected from the group consisting of Ni^{2+} , Co^{2+} , Fe^{2+} , Fe^{3+} , and combinations thereof. The substrate is placed into the electrolytic bath and the electrolytic bath contacts the conducting three dimensional pattern in the substrate or the conducting seed layer within the pattern on a dielectric substrate. A counter electrode is placed into the electrolytic bath. An electric current is passed through the electrolytic bath between the electrical conductive substrate or seed layer on the three dimensional substrate and the counter electrode. At least a portion of the ferromagnetic material is deposited into at least a portion of the three dimensional pattern wherein the at least one deposited ferromagnetic material is substantially void-free.

